

marks testify:—"Hereditary Genius" (1869), "English Men of Science" (1874), "Human Faculty" (1883), "Natural Inheritance" (1889), and his later writings on eugenics. Impressed with the necessity of obtaining a multitude of exact measurements relating to every measurable faculty of body or mind for two generations at least, he first stimulated schoolmasters to weigh and measure their boys, and established an anthropometric laboratory at the International Exhibition of 1884, and subsequently at South Kensington, several of the instruments employed being designed by him. These have formed the model of similar laboratories elsewhere. It was in this connection that he made an exhaustive study of fingerprints as a means of identifying persons, which led to the adoption of the system by the Criminal Departments of Britain, India, and many foreign countries; he also demonstrated that the patterns of the papillary ridges have no racial significance. Numerous experiments were made in composite photography, of which an interesting account is given. In order to ascertain the relative position of individuals, the well-known "centile" method was devised. As a side-issue he suggested the appropriateness of utilising the *median* vote in councils of juries. Being satisfied of the inheritance of mental qualities and that heredity was a far more powerful agent in human development than nurture, he endeavoured to ascertain the degree in which breeding might, at least theoretically, modify the human race. The general result of his inquiry was to support the view "that man is little more than a conscious machine, the slave of heredity and environment, the larger part, perhaps all, of whose actions are therefore predictable."

The strong practical bent that manifests itself in whatever Dr. Galton does constrained him to apply the conclusions to which his studies on human faculty and heredity had led him. Hence of late years he has occupied himself with eugenics, though so far back as 1865 he had formulated its leading principles, and he introduced the term in 1884. He thinks that "stern compulsion ought to be exerted to prevent the free propagation of the stock of those who are seriously afflicted by lunacy, feeble-mindedness, habitual criminality, and pauperism, but that is quite different from compulsory marriage. . . . A democracy cannot endure unless it be composed of able citizens; therefore it must in self-defence withstand the free introduction of degenerate stock. . . ."

The aim of eugenics is to check the birth-rate of the Unfit, and to promote the improvement of the race by furthering the productivity of the Fit by early marriages and healthful rearing of their children, and thereby "to replace Natural Selection by other processes that are more merciful and not less effective." In his last utterance on this subject (*cf.* NATURE, October 22, 1908, vol. lxxviii., p. 645) Dr. Galton gives practical suggestions for creating a public opinion; he rightly recognises the enormous influence wielded by social opinion among all races and classes of mankind, and he would direct this tremendous force towards a favourable consideration of eugenics, trusting that practical

results would ensue to the great betterment of man kind.

This bald, epitomised sketch of the life and activities of Dr. Galton indicates the wide range of his interests and powers. The practical application of scientific principles seems to be always in his mind, never from the point of view of the patentee or exploiter, but invariably disinterestedly, and his eugenic investigations were fired by a burning zeal for the well-being of his fellow-men. The transparent honesty and naïveté of the man are revealed in these straightforward memories. Perhaps we are too close to him to be able to judge how great his life's work will loom when the history of the science of our day comes to be written, but his energy, enthusiasm and character have stimulated many during the past and the present generation, and when these qualities are associated with sound work accomplished and the promulgation of larger views of life and duty, we can confidently await the verdict of posterity.

A. C. HADDON.

AN INTRODUCTION TO THE STUDY OF NATURAL HISTORY.

Animal Life. By Dr. F. W. Gamble, F.R.S.
Pp. xviii+305. (London: Smith, Elder and Co., 1908.) Price 6s. net.

THIS is a fascinating introduction to the study of animal life, marked by freshness of outlook, stimulating exposition, and vivid style. To Dr. Gamble—editor though he be of an austere "Practical Zoology"—animal life is "a pageant," "a moving spectacle," and his inquiry is kinetic throughout. What is all this bustle about, what are the leading motives, what are the ends achieved? In developing his subject he has proceeded by the use of three leading motives that differentiate animals from plants—movement, the acquisition of solid food, and the nervous control of response to changing order, and the three main problems the solutions of which he considers are the maintenance of self, the development of self, and the progress of the race, though he is careful to point out that the last is "rather a motive that possesses animals than is possessed by them." He begins by contrasting animal and plant life:—

"Mass, stationariness, and pliability—the notes of plant life—are replaced in animals by purposeful evasion, activity, and intractability."

Then the fulness of the earth and the abundance of the sea is his theme, and "the mighty gamut of the scale of being." But amid all the multitude of forms and endless variety of architecture there are only a few chief styles, the history of which is briefly sketched. The stage has not always had its present-day scenery and troupe of players. There has been a rise and fall of races.

"Wave after wave of life has risen from the inexhaustible depths of nature, towered to a great height, and has then fallen; yet undelayed the onward movement continues."

Nothing could be better than the chapter on animal

locomotion, which is informative, stimulating, and beautiful. It is interesting to hear of the elbow-joint of the bat-fish, of the agile Malayan lizard that runs securely over the tops of grass shoots, and of the movement of the vanes on the grebe's foot, but it is even more profitable to be led from a few simple experiments with a pennyworth of mussels to some clear ideas in regard to cilia, and then to a recognition that all movement partakes of this mysterious innate character, self-caused and self-sustained. With admirable vividness and a frank enthusiasm, the author pours the finish and unweariedness of animal movement, which increases in perfection as we ascend the scale of being and reaches its highest manifestation in the migration of birds.

But movement implies expenditure of energy, and that leads the author to discuss the varied quest for food—the vegetarian habit and the protection of plants against wholly destructive visitors, the probable origin of the carnivorous habit among marine animals, the stress of terrestrial life, and the three paths by which land animals have become carnivorous. But

"Life is a fire, now slow, now fierce, and therefore needs air as well as fuel. Changefulness is of the very essence of being, and all our rest is but hidden activity. . . . The fire was lighted long ago. The twinkling flames hidden in thought, patent in conduct, have come from the vestal lights of other generations. Every moment of restful or restless activity they maintain the transformation of our bodies. . . . Food is but the laid fuel; oxygen, that which fans it."

This is the beginning of a fine chapter on the breath of life—that is to say, on the comparative physiology of respiration, in which Dr. Gamble shows that evolution corresponds in great part with the successful quest for oxygen.

"Man himself carries in his ears an unmistakable sign of his gill-breathing, watery past, and of the depths he has left behind him."

Breakdown by oxygenation, re-construction by feeding, are the two emulating processes in animal organisms; there is "the downward pull of oxidation and the upward thrust of nutrition," and more and more we see how the trembling balance of life becomes steadied by firm central nervous control. Thus we are led to the seventh chapter, on the nervous and sensory system, which is very illuminating. "Every living thing is an old hand," and the nervous system is the seat of organic memory.

"Not only day and night, winter and summer, seedtime and harvest, set agoing the inward pendulum of animal life, but the life and death of their associates, the swing of the tides, all the great secular movements, beat with alternating force upon the receptive nervous tissue."

In another very interesting part of the chapter the habits of a shrimp and prawn are taken as an example of the way in which the conduct of these animals is built up out of responses to light, pressure, and taste. It is also shown that the stiffening of relatively simple responses into habit and tradition is

a necessary prelude to advance in higher responses. Colour plays so large a part in the business of life that it is in accordance with the perspective of this volume that it should have a chapter to itself. It is a subject with which the author's experience has made him peculiarly well qualified to deal, and we cannot but express our admiration for the way in which he works out the thesis that

"the pigments of animals are older than the effect they produce, and that the old nutritive, purifying, and respiratory uses of colour are the basis for the more recently evolved protective, warning, or mimetic values of colouration."

The summing-up of the book is in the second last chapter, on the welfare of the race, of which the last chapter—on the life-histories of insects—is in greater part a series of illustrations.

"The endowments of the individual, which have at first sight such an appearance of being purely personal acquisitions and advantages, are in reality of racial value,"

and in the love of mates the higher animals

"gather all their gifts to pour them into the lap of the future." "The life of animals and of working men agrees in this, that, consciously or unconsciously, it is a strife to give their children the best chance. Their response to this spirit takes varied forms, but ultimately it is an answer to the same stimulus, and though it seems to arise within us, it is the spirit of a hive whose boundaries are not limited by the seen or tangible."

This book, the interesting contents of which we have hinted at, will delight all who read it, both those who know much and those who know little. It will charm with its style and with the wonders which it discloses. The illustrations, it should be noted, are fresh and interesting, being in great part photographs of specimens in the Manchester Museum. It will help students to organise their knowledge in the light of the general ideas which it expounds, and it will suggest observation and reflection. Sometimes, perhaps, the author is the least thing too exuberant, as when he says:—

"On our rocky coasts, from April to July, the puffin, the guillemot, and other spring migrants of the sea have made the rocks *musical with their chorus*."

Sometimes, perhaps, the author's epigrammatic style makes a difficulty instead of removing one, for there is a little of the conundrum in a sentence like this:—"Soil is the remains of the vesture that waves in the wind and water, held in a meshwork of moulds," and many will be puzzled, not enlightened, by being told that "in man and creature colour is sacramental." But we have confidence in tendering to Dr. Gamble the thanks of thousands of students of animal life, who will find, or have found, in this book one of the most charming introductions to natural history, a book full of insight and suggestion, with a delightful *note personnel*, a contribution not only to science, but to literature.

J. A. T.